What is claimed is:

1. A decoding method for retrieving information bits encoded in a printed image comprising the steps of:
   a) receiving an input electronic image as a scanned version of the printed image;
   b) extracting a region of interest in the image;
   c) estimating, for said region, amount of K colorant present, denoted K_H;
   d) obtaining, for said region, a color value;
   e) determining the GCR used for encoding that region using K_H and said obtained color value; and
   f) retrieving encoded information bits based on said determined GCR.

2. A decoding method, as in **claim 1**, wherein estimated K_H is evaluated conditional to a capacity signal K_L and a luminance signal L.

3. A decoding method, as in **claim 2**, further comprising deriving from said obtained RGB data the values of K_H , K_L, and L, wherein K_H is estimated from a high resolution scan, and K_L and L are estimated from a down-scaled image, respectively.

4. A decoding method, as in **claim 2**, wherein the capacity signal K_L and the luminance signal L are derived from said obtained color value.

5. A decoding method, as in **claim 2**, further comprising determining K_L by:
   a) applying a suitable operator *S* to reduce the image from scanner resolution to the watermark resolution;
   b) converting the obtained color values to CMY estimates; and
   c) using said estimates to determine K-colorant amount by K_L=min(C,M,Y)

6. A decoding method, as in **claim 2**, further comprising determining K-capacity amount, K_L, by:
   a) converting said obtained color values to CMY estimates;
   b) applying a suitable operator S to reduce the image from scanner resolution to the watermark resolution; and
   c) using said estimates to determine K-colorant amount by $K_L = \min(S(C), S(M), S(Y))$.

7. A decoding method, as in **claim 2**, wherein L is described by a linear combination of scan signals RGB, such that $L = k_1S(R) + k_2S(G) + k_3S(B)$.

8. A decoding method, as in **claim 1**, further comprising K_H by:
   a) converting said obtained color values to CMY estimates;
   b) using said CMY estimates to determine K-colorant amount at each pixel by $K = \min(C,M,Y)$; and
   c) applying a suitable operator S to reduce the image from scanner resolution to the watermark resolution, $K_H = S \min(C,M,Y)$.

9. A decoding method, as in **claim 8**, wherein the operator S is a sequence of blurring filters followed by sub-sampling.

10. A decoding method, as in **claim 8**, further comprising converting the said obtained color values to CMY estimates by inverting scanner RGB values, such that $C=1-R$, $M=1-G$, and $Y=1-B$, such that $K_H = S \min(C,M,Y) = S[1-\max(R,G,B)]$.

11. A decoding method, as in **claim 8**, wherein said obtained color values are converted to CMY estimates by a 3x3 linear transformation M of scan RGB values followed by inverting, such that $CMY = 1 - (M \times RGB)$.

12. A decoding method, as in **claim 8**, further comprising calibrating the system by:

a) printing a set of patches of known CMY values;
b) scanning said patches;
c) determining RGB values of said patches;
d) building a transformation between RGB scan values and input CMY values; and
e) using said estimates to determine K_H such that $K_H = \min(C,M,Y)$.

13. A decoding method, as in **claim 12**, wherein the transformation is a 3x3 linear transformation *M* of RGB values followed by inverting, such that CMY = 1–(M x RGB).

14. A decoding method as in **claim 1**, wherein K_H is estimated from a high-resolution scan by a method of thresholding the scan pixels representing the printed K dots.

15. A decoding method, as in **claim 10**, wherein the thresholding is performed in lightness, and dark pixels are considered part of a K-dot.

16. A decoding method, as in **claim 10**, wherein the thresholding is performed in chroma and lightness, and dark, non-chromatic pixels are considered part of a K-dot.

17. A decoding method, as in **claim 10**, wherein the threshold level for K-dots is varied relative to the average darkness of the patch.

18. A decoding method, as in **claim 2**, wherein determining one out of *N*-GCRs comprises:

a) determining one region of said input that was processed with each GCR; and

b) for each region:

computing $\beta(n,K_L,L) = E(K_H \mid K_L, L, GCR=n)$;

determining β that is the closest to K_H;

creating a threshold $\tau(K_L,L) = (½)[\beta(1, K_L, L) + [\beta(2, K_L, L)]$; and

comparing K_H to threshold τ (K_L, L).

19. A decoding method, as in **claim 1**, wherein K_H is evaluated conditional to the average said obtained color value of the decoding region, RGB.

20. A decoding method, as in **claim 19**, further comprising deriving from said RGB data the values of K_H, R, G, B, wherein K-colorant amount, K_H, is estimated from a high resolution scan, and R, G, and B are estimated from a down-scaled image, respectively.

21. A decoding method, as in **claim 19**, wherein estimating one out of N-GCRs comprises:

a) determining one region of said input that was processed with each GCR; and

b) for each region,

computing □(n,R,G,B) = E(KH | R,G,B, GCR=n);

determining □ that is the closest to KH;

creating a threshold □(R,G,B) = (1/2)[□(1, R,G,B) + [□(2, R,G,B)]; and

comparing KH to threshold □ (R, G, B).

22. A decoding method, as in **claim 1**, wherein determining said GCR is accomplished by processing said estimated K-colorant amount, K_H, and said color value through a look-up table.

23. A decoding method, as in **claim 22**, wherein the look-up table has as inputs a transformation of scanner values.

24. A decoding method, as in **claim 23**, wherein the look-up table has output the estimated K-colorant amount for each of *N* possible GCR strategy, K_1, K_2, ..., K_N.

25. A decoding method, as in **claim 24**, wherein estimating the GCR comprises:
    a) mapping the average scanned color of the region of interest through the lookup table to obtain K estimates for each possible GCR function, K1, K2, ..., K*N*, for *N*-GCR strategies;
    b) comparing the K-colorant amount estimated from the region of interest, KH, to each of the said K estimates from the lookup table mapping; and
    c) selecting the GCR function whose K estimate is closest to KH.

26. A decoding method, as in **claim 24**, in which two GCR strategies are used wherein the look-up table has as its output the threshold K-colorant value, K_T, for differentiating between the two strategies, which equal $\frac{1}{2}(K_1+K_2)$.

27. A decoding method, as in **claim 25**, wherein estimating the GCR comprises:

a) mapping the average scanned color of the region of interest through the lookup table to said obtain K_T;

b) comparing said estimated K_H for the region of interest to K_T; and

c) selecting said GCR function corresponding to whether $K_H > K_T$ or $K_H < K_T$.

28. A decoding method, as in **claim 22**, wherein an additional output of the look-up table expresses a confidence in the ability to differentiate among the different GCRs for that particular local color.

29. A decoding method, as in **claim 23**, wherein an additional input to the look-up table is K_H and wherein the look-up table has as its output a discrete number *Q* that indicates which GCR was used to print that given scanned pixel.

30. A decoding method, as in **claim 29**, wherein the derivation of *Q* comprises:

a) dividing the RGBK hyper-cube into *N* cells;

b) for every pixel in the image:

finding said pixel's RGBK cell; and

filling in said pixel's Q value; and

c) for each of said cells:

computing the histogram of the set of said Q values; and

associating said cell with the most popular Q value for that cell.

31. A decoding method, as in **claim 30**, wherein estimating the GCR comprises for every pixel in the low resolution image:

a) computing $RGBK_H$ quadruple;

b) entering said obtained RGB and said estimated K_H into the cell LUT; and

c) retrieving Q thereby indicating the GCR estimation.

32. A decoding method, as in **claim 22**, wherein construction of the look-up table comprises:

a) deriving a set of CMY data;

b) processing said CMY data through each of said *N*-GCR functions to produce *N* sets of CMYK data;

c) generating at least one target of patches corresponding to the said *N* sets of CMYK data sets;

d) printing said at least one target;

e) scanning said at least one target using the scanner to be used in the decoding of subsequent watermarked images;

f) for each patch in the scanned image, estimating the amount of K-colorant, K_H, present;

g) deriving a relationship between a function of said scanned signals and said amount of K_H present for each patch; and

h) estimating the GCR used for encoding said image region by using the said relationship in conjunction with the said K and average scanned color for the input electronic image.

33. A decoding method, as in **claim 32**, wherein the target generation comprises building a separate target for each GCR function.

34. A decoding method, as in **claim 32**, wherein the target generation comprises building a single target that includes multi-partite patches, wherein each part of a patch is determined from a different GCR function.